CLAIMS

1. A biologically functional surface immobilized multilayer structure comprising a plurality of vesicles (2) sufficiently spaced apart from said surface (1), wherein the vesicles are directly attached to the structure by surface-immobilized linkers (4) with a vesicle-attached linkers (5) and optionally by vesicle-attached linkers to another vesicle and wherein said vesicles comprise the biologically active compounds (6) which provide the structure with its biological functionality.

2. A structure according to claim 1, wherein said vesicles are directly attached to the surface immobilized linkers (4) with vesicle-attached linkers (5), so that at least two vesicles are attached to each linker (4) and wherein each vesicle attached linker is adapted to bind to said linker (4) but not to another vesicle attached linker.

3. A structure according to claim 1, wherein the vesicles are attached to said structure by

a) the surface immobilized linker; and
b) vesicle-attached linkers,

so as to provide said structure with two or more of vesicle layers.

4. A structure according to any one of claims 1 to 3, wherein said linkers (4, 5) comprise oligonucleotides, and said binding of a linker to

another linker is mediated through hybridisation of said oligonucleotides.

5. A structure according to any of the claims 1 or 4, wherein said vesicle attached linkers (5) are attached to said vesicles (2) via at least one of a hydrophobic anchoring moiety comprised in said linker (5), and a covalent bond to said vesicle (2) via a functionalised group comprised in said linker (5).

6. A structure according to any of the claims 1 to 5, wherein said vesicles (2) are coated with an outer shell comprising of compounds chosen from the group comprising polyethylene glycol, S-layer proteins, peptides, metal clusters and polymers, or where the lipids themselves are linked by polymerisation.

7. A structure according to any of the claims 1 to 6, wherein the interior volume (8) of said vesicles (2) comprises compounds chosen from the group comprising ions, dyes, drugs, antibodies, enzymes and other proteins.

8. A structure according to any one of claims 4 to 7, wherein said hybridisation of said oligonucleotides is essentially sequence specific.

9. A structure according to any one of claims 1 to 8, adapted for release of said multilayer structure from said surface (1).

10. A structure according to claim 9, designed so that said release is triggered by an electrical potential, light, osmotic stress or incubation with a

compound which stimulates said release.

11. A biologically functional surface immobilized multilayer structure comprising a plurality of vesicles (2), sufficiently spaced apart from said surface, wherein the vesicles are directly attached along surface immobilized linkers (4) with vesicle attached linkers, so at least two vesicles are attached to each linker (4).

12. A structure according to claim 11, wherein each vesicle-attached linker is adapted to bind to the surface immobilized linker but not to another vesicle attached linker.

13. A structure according to claim, 12 wherein said surface immobilized linker (4) comprises at least one non-linker attached region with a biological functionality.

14. A structure according to any one of claims 12 or 13, wherein said vesicles comprise compounds (6) exhibiting a biological functionality.

15. A structure according to any one of claims 12 to 14, wherein said non-linker attached region is capable of specific binding with an analyte.

16. A structure according to any one of claims 12 to 15, wherein said linkers (4, 5) comprise oligonucleotides, and said binding of a linker to another linker is mediated through hybridisation of said oligonucleotides.

17. A structure according to any of the claims 12 to 16, wherein said vesicle attached linkers (5) are attached to said vesicles (2) via at least one of a hydrophobic anchoring moiety comprised in said linker (5), and a covalent bond to said vesicle (2) via a functionalised group comprised in said linker (5).

18. A structure according to any of the claims 12 to 17, wherein said vesicles (2) are coated with an outer shell comprising of compounds chosen from the group comprising polyethylene glycol, S-layer proteins, peptides, metal clusters and polymers, or where the lipids themselves are linked by polymerisation.

19. A structure according to any of the claims 12 to 18, wherein the interior volume (8) of said vesicles (2) comprises compounds chosen from the group comprising of ions, dyes, drugs, antibodies, enzymes and other proteins.

20. A structure according to any one of claims 16 to 19, wherein said hybridisation of said oligonucleotides is essentially sequence specific.

21. A structure according to any of the claims 12 to 20, adapted for release of said multilayer structure from said surface (1).

22. A structure according to claim 21 designed so that said release is triggered by an electrical potential, light, osmotic stress or incubation with a compound, which stimulates said release.

23. A biologically functional surface immobilized multilayer structure comprising a plurality of vesicles (2), wherein the vesicles are directly attached to the structure by surface immobilization and by vesicle attached linkers (5) to another vesicle and wherein at least a selected population of said vesicles comprise the biologically active compounds (6) which provide the structure with its biological functionality.

24. A structure according to claim 23, wherein the surface immobilisation of vesicles involves direct attachment to the structure by surface immobilized linkers (4) by vesicle attached linkers (5).

25. A structure according to claim 23, wherein the surface immobilization of vesicles involves a first population of vesicles adapted for direct surface attachment each having at least one vesicle-attached linker (5) capable of binding to another vesicle-attached linker.

26. A structure according to any one of claims 23 or 24, wherein said linkers (4, 5) comprise oligonucleotides, and said binding of a linker to another linker is mediated through hybridisation of said oligonucleotides.

27. A structure according to any one of claims 23 to 26, wherein said vesicle attached linkers (5) are attached to said vesicles (2) via at least one of a hydrophobic anchoring moiety comprised in said linker (5), and a covalent bond to said vesicle (2) via a

functionalised group comprised in said linker (5).

28. A structure according to any one of claims 23 to 27, wherein said vesicles (2) are coated with an outer shell comprising of compounds chosen from the group comprising polyethylene glycol, S-layer proteins, peptides, metal clusters and polymers, or where the lipids themselves are linked by polymerisation.

29. A structure according to any one of claims 23 to 28, wherein the interior volume (8) of said vesicles (2) comprises compounds chosen from the group comprising of ions, dyes, drugs, antibodies, enzymes and other proteins.

30. A structure according to any one of claims 23 to 29, wherein said hybridisation of said oligonucleotides is essentially sequence specific.

31. A structure according to any one of claims 23 to 30, adapted for release of said multilayer structure from said surface (1).

32. A structure according to claim 31, designed so that said release is triggered by an electrical potential, light, osmotic stress or incubation with a compound which stimulates said release.

33. A method for producing a surface-immobilised multilayer structure of a plurality of vesicles, comprising the steps of:

(i) providing a surface (1) comprising either, at least one linker (4) immobilised onto the surface, said surface-immobilised linker(s) being adapted and available for binding to at least one vesicle-attached linker (5), or a first layer of directly surface-immobilised vesicles each provided with one or more vesicle-attached linkers (5);

(ii) providing vesicles (2), each comprising at least one outwardly projecting linker (5) attached thereto, said vesicle-attached linker (5) being adapted and available for direct binding to a surface-immobilised linker (4) or another vesicle-attached linker (5),

(iii) incubating at least one of the vesicles (2) with the surface (1) under conditions promoting binding of the vesicle-attached linker(s) directly to the surface-immobilised linker(s) or to vesicle-attached linker(s) already immobilised into the structure, resulting in

(iv) immobilisation of the vesicle(s) and the linker(s) attached thereto into the structure, which after this step comprises at least one structure-immobilised linker and/or surface-immobilised linker available for binding to another vesicle-attached linker (5), and

(v) repeating the previous step or the previous two steps until the desired amount of vesicles (2) are immobilised into said structure;

34. A method according to claim 33, wherein said surface-immobilised linker (4) comprises at least two sites for binding of vesicle-attached linkers (5).

35. A method according to claim 34, wherein each vesicle-attached linker (5) is adapted to bind to the surface-immobilised linker (4) but not to another vesicle-attached linker (5).

36. A method according to claim 33, wherein said surface-immobilised linker (4) comprises only one site for binding of vesicle-attached linkers (5).

37. A method according to claim 36, wherein each vesicle comprises at least two vesicle-attached linkers (5).

38. A method according to any one of claims 33 to 37, wherein said linkers (4, 5) comprises oligonucleotides, and said binding of a linker to another linker is mediated through hybridisation of said oligonucleotides.

39. A method according to any one of claims 33 to 38, wherein said vesicle attached linkers (5) are attached to said vesicles (2) via at least one of a hydrophobic anchoring moiety comprised in the linker, and a covalent bond to said vesicle via a functionalised group comprised in the linker.

40. A method according to any one of claims 33 to 39, wherein said vesicles (2) comprise biologically active compounds (6) exhibiting a biological functionality.

41. A method according to any one of claims 33 to 40, wherein said vesicles (2) are coated with an outer shell comprising of compounds chosen from the group comprising polyethylene glycol; S-layer proteins, peptides, metal clusters and polymers.

42. A method according to any one of claims 33 to 41, wherein the interior volume of said vesicles (2) comprises compounds chosen from the group comprising of ions, dyes, drugs, antibodies, enzymes and other proteins.

43. A method according to any one of claims 33 to 42, wherein said surface (1) comprises several surface-immobilised vesicles, which serves as a binding matrix for said structure.

44. A method according to claim 38 or any one of claims 39 to 43 when dependent on claim 38, wherein said incubation is performed under conditions promoting sequence specific hybridisation of said oligonucleotides.

45. A method according to any one of claims 33 to 44, also comprising the step of releasing compounds from the vesicles (2).

46. A method according to claim 45, wherein said release is triggered by an applied electrical potential osmotic stress or incubation with a compound, which stimulates said release.

47. A method for producing a multilayer structure of

a plurality of vesicles, comprising the method according to any one of claims 33 to 46, followed by the step of releasing said multilayer structure from said surface (1).

48. A method according to claim 47, wherein said release is triggered by an electrical potential, osmotic stress or incubation with a compound, which stimulates said release.

49. The use of a structure according to any of the claims 1 to 32 or produced according any of the claims 33 to 48, as a biosensor.

50. The use of a structure according to any of the claims 1 to 32 or produced according any of the claims 33 to 48, in a biosensor.

51. The use according to claim 50, wherein the formation of said structure is monitored by said biosensor.

52. The use according to any of the claims 50 to 51, wherein said biosensor is an optical biosensor, and said structure is used for increasing the signal of said optical biosensor.

53. The use according to any of the claims 50 to 51, wherein said biosensor is a mechanical biosensor, and said structure is used for increasing the signal of said mechanical biosensor.

54. The use a structure according to any of the claims 1 to 32 or produced according any of the

claims 33 to 48 for specifically removing or extracting one or several compounds (7) from a complex solution of compounds.

55. The use of a structure according to any of the claims 1 to 32 or produced according any of the claims 33 to 48 for sensoring a release of compounds from the vesicles (2).

56. The use according to claim 55, wherein said release is triggered by an applied electrical potential, osmotic stress or incubation with a compound, which stimulates said release.

57. The use according to any one of claims 55 to 56, wherein said release is used for specific or localised drug delivery.

58. The use according to any one of claims 55 to 56, wherein said release is used as a biosensor.

59. The use according to any one of claims 49 to 58, for simultaneous analysis of several compounds.

60. The use of a structure according to any of the claims 1 to 32 or produced according any of the claims 33 to 48 for imaging.

61. A kit of parts comprising chemical compositions appropriate for the production of a surface-immobilised multilayer structure of a plurality of vesicles according to any of the preceding claims, comprising linkers (4, 5), vesicles (2), compounds for attaching said linkers to said vesicles, and

compounds for immobilising said linkers (4, 5) to a surface (1).

62. A kit of parts according to claim 61, also comprising at least one of compounds for attaching biologically active compounds to said vesicles (2), and biologically active compounds (6)